US EPA RECORDS CENTER REGION 5



REPORT

Subsurface Soil Exploration Study
Griffith Sanitary Landfill
Griffith, Indiana

Prepared for:

Torrenga Engineering, Inc. 907 Ridge Road Munster, IN 46321

Attn: Mr. Don Torrenga



Testing and Engineering Inc.

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August 24, 1987

File No. 220

Torrenga Engineering, Inc. Engineers & Surveyors 907 Ridge Road Munster, IN 46321

Attn: Mr. Don Torrenga

REPORT

Subsurface Soil Exploration Study Griffith Sanitary Landfill Griffith, Indiana

Dear Mr. Torrenga:

We have completed a subsurface exploration study for the above referenced project. This exploration was performed in accordance with your verbal authorization. Additionally; later part of our work was verbally authorized by Mr. Glenn W. Slaney, Director, Public Works, Town of Griffith, Indiana.

This report includes a summary of our field exploration, site characterization and engineering analysis based on our analysis of the soil boring data.

We appreciate the opportunity to be of service to you on this project. If you have any questions, please call our office.

Very truly yours,

K & S Testing and Engineering, Inc.

Dibakar Sundi, P.E. Project Engineer

Petar Kostur, P.G

President

DS:PK/cac

Subsurface Soil Exploration Griffith Sanitary Landfill Griffith, Indiana

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1.0 INTRODUCTION

1.1 Purpose

This study was undertaken to assess the subsurface soil conditions, assess the suitability for using new areas for placing fill within the existing landfill site, and assess any potential migration.

The body of the report contains a summary of our field and laboratory activities and engineering assessments.

The field exploration procedures, boring logs and laboratory test data and details of monitoring well construction are attached with this report.

1.2 Background

We understand the landfill was opened in the 1950's and has been in use since that time. We also understand that this landfill is primarily used for sanitary waste disposal. The portions of this landfill have been filled, these filled areas are marked (Phase I through Phase IV) in the topographic plot plan.

1.3 Work Summary

Our field work consisted of three (3) exploratory soil borings initially. In this report these borings are identified as Soil Borings 6, 7 and 8 or for brevity SB-6, SB-7 and SB-8. The soil borings were drilled with a truck-mounted rotary drill rig using 3.25 inch I.D. hollow-stem augers. Standard split-spoon penetration testing was performed as each boring was advanced to provide blow count data and soil samples for testing. During the drilling, the sampling was done continuously, to the entire boring depths. Ground water was observed and water levels recorded while drilling. At the completion of drilling at each location, the boreholes were grouted shut. The later part of our work consisted of drilling four borings and installing monitoring well at each location. The soil boring logs and the details of monitoring well construction are attached with this report. A few days after construction of the monitoring wells, the wells were purged by using compressed air. The sampling for chemical testing from the wells was performed on June 5, 1987. The results of the chemical analysis on the water

samples are also attached with this report. Our field and laboratory work were combined with published geologic information and our experience to form the basis of this report.

2.0 SITE CHARACTERIZATION

2.1 General

The Griffith Sanitary Landfill site is located on the west side of Colfax Avenue. To the north, the landfill site is bounded by the C & O R. R. and to the south by the C & E R. R. property. The regional site location and topography are shown on Exhibit 1, which is the reproduction of the local U.S.G.S. topographic map.

2.2 Surface Conditions

The surface topography of the unused portions of the landfill area has a gentle slope or is flat. The filled area shown (Phase I through Phase IV) in the topographical plot plan (prepared by Torrenga Engineering, Inc.) is higher than the unused portions of the landfill site. There is an existing drainage ditch along the north side of the C & E R. R. A drainage ditch also exists on the south side of the C & O R. R. These two ditches are connected by a drainage ditch existing on the western portion of the landfill site. As shown in the topographic plot plan, some excavations were recently made on the western portion near the C & E R. R. property.

The ground surface surrounding the landfill site is relatively flat with elevations around 630.0 feet MSL. Locally, on the eastern edge of the site the surface topography is at a higher elevation. The site and the surface topography are shown in the USGS topographic map and are attached with this report.

2.3 Subsurface Conditions

2.3.1 Basis

The data base for the subsurface conditions presented in this report is the field work conducted during this study, published geologic information, and prior subsurface explorations. Our interpretation of the subsurface conditions is based on interpolation and inference between widely spaced borings.

2.3.2 Site Geology

The site is formed of sediments deposited late during the Wisconsin Age as lake-bottom and near shore deposits of Glacial Lake Chicago. These sediments consist of fine lake silt and clay, sand and fine gravel laid down as glacial outwash and as till inclusions, and clay-rich till units of varying thickness. The site is a part of the Calumet Lacustrine Plain, which is a geologically heterogeneous area that has interlayed sand, lake clay, and till, forming the bulk of the sedimentary units. These sediments are water-laid sands and clays; the wind-blown dune sands being next in abundance. The deposits in a particular locality, whether wind or water-laid, sand or clay have very similar strength properties.

2.3.3 Soils

In summary, the undisturbed areas of this site have about a 12.0 to 14.0 foot thick layer of brown and gray fine to medium sand. This sand has been excavated in the area of Boring 6. Underlying the sand, we encountered a layer of preconsolidated silty clay. The thickness of this clay layer was noted to be about 16.0 feet (extends between elevation 619.09 ft. and 603.29 ft.) in Boring 7 and about 23.0 feet (extends between elevations of 620.31 ft. and 597.31 ft.) in Boring 8. In Boring 6 the clay starts at the surface and it extends to a depth of 12.0 feet (elevation 611.55 to elevation 599.55 ft.). Underlying, Boring 6 and 8 found alternate layers of sand and clay to the total depth of the borings. However, Boring 7 encountered gray sand beneath the clay layer which extended to the total boring depth of 54.5 feet; elevation 578.59 feet.

Boring M-l encountered 19.5 feet (elev. 612.34) of black, brown and gray sand, and silty sand. Underlying; we primarily noted stiff to hard gray silty and sandy clay to a depth of 44.5 feet (elev. 587.34). Underlying soil to our drilling depth of 50.5 feet consists of medium dense to very dense gray fine to coarse sand.

In M-2 we noted 19.0 feet of brown, dark brown and gray sand and organic peat between 5.5 and 8.0 feet. Between the depths of 19.0 (elev. 616.18) and 49.0 (elev. 586.18) we primarily encountered very stiff and hard gray

silty clay. The underlying soil to our boring termination depth of 55.0 feet (elev. 580.18) consists of dense and very dense gray fine to coarse sand.

Soil conditions in M-3 are somewhat different than the remainder of the soil borings at this site. Beneath 12.0 feet of sand, this boring found 11.0 feet of stiff to hard gray silty clay and generally medium dense to dense gray sand to our drilling depth of 31.0 feet (elev. 599.25). The soil conditions in M-4 are similar to the majority of the borings at this site. Sand was noted in this boring to a depth of 12.5 feet and then generally stiff to hard gray silty clay to the depth of 45.0 feet (elev. 588.5), with the exception of a thin sand layer between 19.0 and 19.5 feet and between 37.5 and 39.0 feet. Below the depth of 45.0 feet and to our drilling depth of 51.0 feet we noted medium dense gray fine to coarse gravelly sand.

The ground water was noted in the upper sand layer. During our field drilling, ground water was noted at about 3.0 feet in Boring 8, 6.0 feet in Boring 7, 1.5 feet in M-1, 11.0 feet in M-2, 3.0 feet in M-3 and 4.5 feet in M-4. Additionally, the sand samples obtained at deeper depths below the upper clay horizon were also wet. The record of water level elevations in the monitoring wells taken a few times after their construction is attached with this report.

2.3.4 Bedrock

Bedrock was not found at this site to the depth of drilling at 55.0 feet. However, published geologic information accounts for the consolidated rocks of Lake County, which consists of more than 4,000 feet of limestone, dolomite, sandstone, and shale of the Cambrian through Devonian Age, which rests on a granitic basement that is designated Precambrian. The rocks constitute a series of strata that are relatively flat lying, but that are gently flexed to form a saddle like structure. This saddle, a part of the Kankakee Arch, rises between the Michigan Basin to the northeast and the Illinois Basin to the southwest. Structural dip or inclination of the bedrock units, is generally southeastward, although the dip is northwestward in the northeast sector of Lake and Porter Counties. The average dip is about 5 to 7 feet per mile.

The bedrock surface which lies beneath 15 to 270 feet of unconsolidated glacial material, is largely a preglacial erosional feature and is not reflected by the present glacially derived land surface. The highest and coincidentally the shallowest area of bedrock lies under the Kankakee Plain in southern Lake County. This bedrock high is part of a northeast-southwest trending ridge of Devonian limestone and shale in the southern part of the two counties. The surface drainage was northward from all but the south edge of the area. This bedrock ridge was the drainage divide. Bedrock elevation ranges from a low of about 450 feet above sea level near Lake Michigan to a high of about elevation 650 feet on the ridge in the south, under the Kankakee Plain. The bedrock surface elevation of our study site is expected to be within elevation of 500 to 550 feet, or within 80 to 130 feet below the existing site surface.

2.4 Hydrogeology

2.4.1 Regional Hydrogeology

The regional hydrogeology in the Lake County area can be typified by a thin upper mantle of water-bearing soils about 20 feet or so thick. The water source is primarily direct infiltration of precipitation and these deposits generally drain to the nearest waterway leading to the Calumet River and then to Lake Michigan. The area is fairly level and the natural drainage is low. The relatively recent urbanization has extensively modified the topography by creating ditches and drains.

Clayey glacial tills underlie these water-bearing soils and form an effective aquiclude. The till is a homogeneous mixture of sand, silt and clay with silt and clay size particles being the predominant particle size. These silt and clay size particles form a relatively impermeable soil matrix. Stratified drifts of coarser materials are present below the upper clayey till.

Underlying the till is the Devonian shale and limestone and Silurian dolomite and limestone and is considered to be a source of partial potable water supply. This bedrock aquifer is most productive, and it has the greatest water supply potential. Contamination from the surface is not as great in the shallow bedrock as it is in the unconsolidated system.

2.4.2 Site Hydrogeology

The site hydrogeology is similar with the regional hydrogeology. In general, it consists of a layer of water-bearing sandy soils with a low ground water flow gradient, clayey glacial till, followed by coarser grained or clayey layered soils resting on bedrock.

We believe that the site ground water originates primarily from direct infiltration of rainfall. The existing ditches on the west and north of the site serve as a drainage from the site.

We believe, we penetrated the upper clayey till in the three borings (SB-6, SB-7 and SB-8) completely during the initial phase of our field work and later in the borings during the construction of monitoring wells. The soil conditions at the study site correlate well with the regional hydrogeology. Grain sizes performed on the site clay show higher percentages of fines consisting of silt and clay size particles. Hydraulic conductivities were measured on four relatively undisturbed shelby tube samples. The coefficient of permeability values ranged between 1.6 x 10^{-8} cms/sec to 2.4 x 10^{-8} cms/sec on the gray silty clay samples. The clay is very stiff to hard in consistency. Additionally, a coefficient of permeability value of 1.4 x 10^{-6} cms/sec was determined on the clay sampled from Boring M-4. This clay is described as gray silty and sandy clay or sandy and clayey silt (CL-ML).

3.0 SITE ASSESSMENT

3.1 General

The presentation of our site assessment is organized to first consider the soil characteristics, both physical and geochemical. We then have discussed future migration potential.

The following assessment and our summary presented are based on the information contained in the report, our experience and engineering judgment.

3.2 Soil Properties

3.2.1 Physical

The soil type at this site is well defined starting with outwash and eolian deposits of sandy soils in the upper layer, clayey till below with occasional sandy seams followed by sandy soils. In general, the clayey till has low plasticity index, with moisture contents of less than 20.0 percent range, about 90.0 percent fines and has a hydraulic conductivity in the order of 10^{-8} cms/sec. The granular deposits can be expected to exhibit hydraulic conductivities in 10^{-2} cms/sec. to 10^{-4} cms/sec. range depending primarily on the percent of silt in the deposit.

3.2.2 Geochemical

The cation exchange capacity testing was performed on the clayey till by Suburban Laboratories, Inc., Hillside, Illinois. The test results are typical of glacial deposits and are attached with this report. The test results on the water samples are also attached with this report.

3.3 Migration Potential

The significant aquiclude at this site is the clayey till found below the near surface water-bearing sandy soils. The clayey till appears continuously with occasional drifts of sandy seams at this site and has lower hydraulic conductivity on the order of $10^{-8} \, \mathrm{cms/sec}$. It may be mentioned here that the lower water-bearing sandy soil appeared to be under an artesian

head as evidenced during the field drilling operation of Boring 6. From which assumptions may be made that the clayey till is providing a significant protection against leachate infiltration to the deeper water-bearing soils.

The potential for surface or near surface horizontal migration at this site may be likely, unless provisions are made to contain the leachate or prevent it to flow horizontally away from the site.

3.4 Summary

Based on available information, test results and findings as presented in this report, we conclude the following:

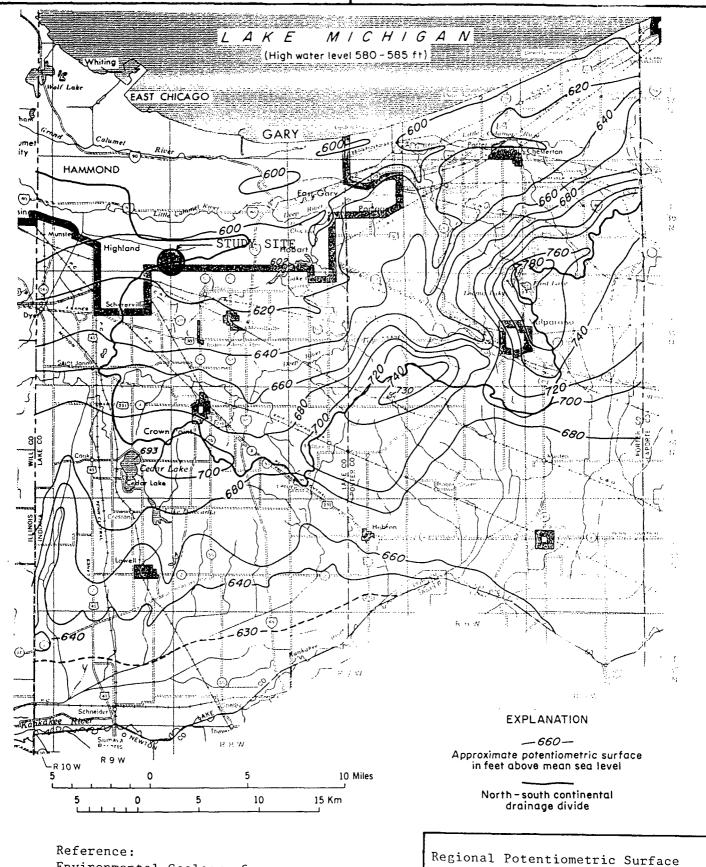
- 1. The soil conditions at this site generally conform with the published geologic and hydrogeologic information for the region.
- 2. The ground water is in the near surface sandy deposit which occurs at a shallow depth from the surface.
- 3. It appears that the clayey till is serving as an effective confining aquifer, protecting the deeper water-bearing soils.

REFERENCES

- 1. Conversations with Torrenga Engineering , Inc.
- 2. Soil Borings, 1974 by Salisbury Engineering, Inc.
- 3. USGS Topographic Map, Department of Interior Geological Survey.
- 4. Foundation Engineering, Ralph B. Peck, Walter E. Hanson, and Thomas H. Thornburn.
- 5. Environmental Geology of Lake and Porter Counties, Indiana An Aid to Planning, Edwin J. Hartke, John R. Hill, and Mark Reshkin,
 State of Indiana Department of Natural Resources, Geological Survey.

K& S Testing and Engineering Inc.

9715 Kennedy Ave. Highland, Indiana Phone: (219) 924-5231



Reference: Environmental Geology of Lake and Porter Counties, Indiana Special Report 11.

Regional Potentiometric Surface Griffith Sanitary Eandfill Griffith, Indiana

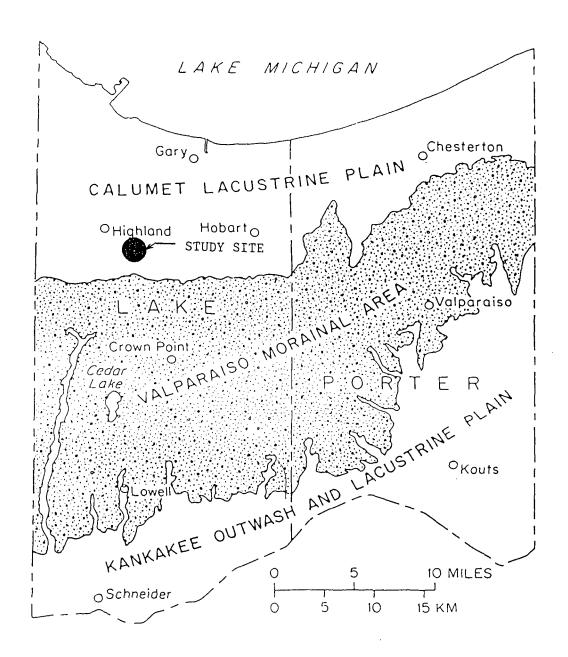
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K&S Testing and Engineering Inc. 9715 Kennedy Ave. Highland, Indiana Phone: (219) 924-5231

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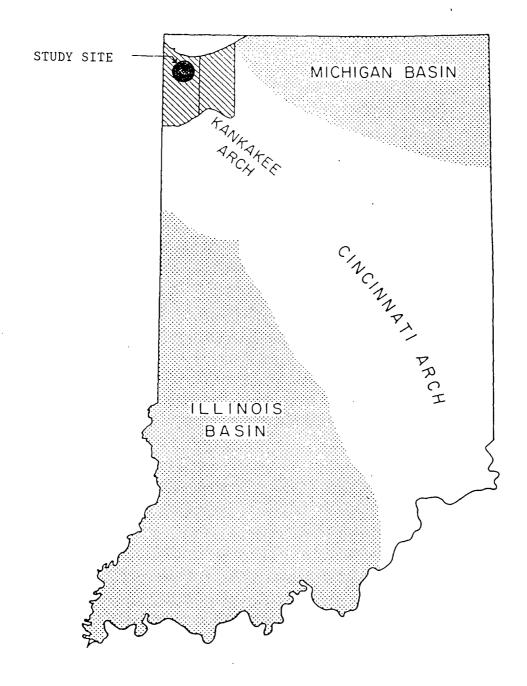
9715 Kennedy Ave. Highland, Indiana Phone: (219) 924-5231



REFERENCE:

Environmental Geology of Lake and Porter Counties, Indiana Special Report 11. Physiographic Units Griffith Sanitary Landfill Griffith, Indiana

FILE 220 DATE 5/3/86



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Environmental Geology of Lake and Porter Counties, Indiana Special Report 11.

Major Bedrock Structural Features Griffith Sanitary Landfill Griffith, Indiana

FILE 220

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RA1	DESCRIPTION OF MATERIAL				Σ O	△ STAN	IDARD PENETRA	TION, BLOWS	 УFТ.		
ST	31.				z	10	20	30 40	50		
-	Mixed black & bro	wn sand fill.			1						
L 1.5			_	$V \mid \cdot \mid$							
			_2.5 _		2	,		▼ Waj	er		
				U	-	1	7		Level		
E	Medium dense gray	fine to medium sand.									
-			_5.0 -	$U \mid V$	3		\nearrow				
<u> </u>				1	4		Å		.		
				$/ \perp$			7]			
			_ 7.5 _		5)	1 1			
<u> </u>		·		\coprod			4				
E			-10.0-		6		4				
E											
E				/	7		2	1 1			
_12.3			12.5								
I-				/	8		?				
ı-	Very stiff to her	d gray silty clay.	75.0		9				ļ		
 -	very still to har	u gray sirry cray.	_15.0_	/			A = A				
F	;				l	•		\setminus	Ì		
F			-17.5-	//	10		9	分			
F			-17.5-	1							
F				! /	11		•	A			
<u> </u>			20.0	1/			7		ľ		
E				U_{\perp}	12		71	4			
<u> </u>				1/	13						
F			-22.5-	! /	_		•	4			
-					١						
E					14 15			4			
	- WATER LEVEL WHILE DRILLING 3.0 ft			1/1_	13		1				
1 -					(K & S TE				
-	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CORE			9715 KENNEDY AVENUE							
-	_						LAND, INDIA				
+PL-PL	LASTIC LIMIT +LL · L	IQUID LIMIT fc - UNIT DRY W	Liani	<u> </u>		1ELEI	PHONE: (219) 9 24-523' 	l 		

CLIEN	T		LOG OF	ВО	RING	NUMBER				
]				(sheet 2)						
SITE LO	SITE LOCATION PRO				AME					
Colf	ax Avenue, Griffit	h, Indiana	Gri	ffi	th	Sanitary :	Landfill			
BORING STARTED	01-31-86	RIG CME-55	FILE NU	JMBE	R	CALIBRAT	ED PENETROME	TER, TONS/F	т.²	
	TED 02-03-86	FOREMAN D. Koditek	220 UNCONFINED COMPRESSIVE STRENGTH.							
	GUESAGE ELEVATION 632.61				PLE	1	2 3	4 5	·	
EPT	EP -			[≿	~	● WATER CO	NTENT PERCEN	т		
TA C	DESCRIPTI	ON OF MATERIAL	DEPTH (FT.)	P P	NUMBER	 -	20 30		50	
TRA	DESCRIPTION OF MATERIAL			TYPE RECOVERY	N	14	PENETRATION,			
\				7 4	-	10	20 30	40	50	
 				//	15	9				
F	Very stiff to har	d gray silty clay.	27.5	7	16		$ \lambda $			
_	, -			4	16		1 7			
				M	17		>			
			-30.0-	\coprod			1 1 /	7		
L				I/I	18		K			
E !				/}-	1		1 1			
Ė.			_32.5_		19					
-					20					
			35.0		20					
36.0	Medium dense gray	fine to coarse sand.		Λ	21	/	1			
<u> -</u>			27 6		1	分				
_			_37.5_		22	4				
1	77			//	1,,					
i l	Very stiff gray s	ilty clay.	40.0	//	23	,				
E					ł		7 7			
-			-	/	24		1 4			
F			42.5	II	25					
_43.5 _44.0	W 11 6			! /				•		
F	Medium dense i	ine to medium sand, wet	45.0	Λ	26					
F	Very stiff gray s	ilty clay.		/	120					
47.0				1/1	27		λ			
L ⁴ /.0	47.0			/ }_	1			\downarrow		
E	Dense gray fine to medium sand, wet.			1/	28]		Δ		
E	<u>-</u> \				29					
- 14/4	▼ WATER LEVEL WHILE DRILLING 3.0 ft.			14.1_	1					
\ -					(l ITI <i>i</i>	& S TESTII		· 	
¥ WA	WATER LEVEL			ENGINEERING INC. 9715 KENNEDY AVENUE						
SPL	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CORE						D, INDIANA 4			
+PL · PL	LASTIC LIMIT +LL - L	QUID LIMIT & . UNIT DRY WEI	GHT			TELEPHO	NE: (219) 924	I-5231		

CLIEN	·				LOG OF BORING NUMBER							
Torr						(sheet 3)						
SITE LO	OCATION		PROJEC [*]	CTNAME iffith Sanitary Landfill								
Colf	fax Avenue, Griffit	ch, Indiana	Grif	fi	th	Sanita	ry L	andfi	11		•	
BORING STARTED	01-31-86	RIG CME-55	FILE NU	ИВE	R	CAL						
BORING COMPLET	02 02 06	FOREMAN D. Koditek	220)		O TO	CONFINE NS/FT²	ED COMP	RESSIVE :	STRENGT	н,	
	SURFACE ELEVATION	632.61		SAM	PLE	1	2	3 		5 		
)))	OEP			RY	Œ			TENT PER			İ	
TA [DESCRIPTION 052.61 DESCRIPTION OF MATERIAL			VE	NUMBER	10	20				0	
TR/	ART			RECOVERY	Ď.				TION, BLO 0 4			
	o l				29						Δ	
-				H						Å		
 - -			-52.5		30		-			4		
r	Dense gray fine t	o medium sand, wet.	-32.5	\prod	31							
- -54.5											69 ∆	
<u> </u>	END OF BORING]				· •		
- -												
							Ì					
-						ŀ				Ì		
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<u> </u>					1		<u> </u>	<u>L</u>	<u> </u>	<u> </u>	<u> </u>	
	WATER LEVEL WHILE DRILLING 3.0 ft.				(STING			
¥ WA	WATER LEVEL					W			RING			
SPL	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CORE								AVENUI NA 463		}	
+PL · PI	LASTIC LIMIT +LL-	LIQUID LIMIT . F - UNIT DRY	WEIGHT .			TELE	PHON	E: (219)	924-52	231		

				LOG OF BORING NUMBER							
Torrenga Engineering				M-	-1,	Sheet	1 of	2			
SITE LO	SITE LOCATION			CT N	AME						
Co1:	Colfax Avenue, Griffith, Indiana			ffi	th	Sanit	ary L	andfi	.11		
BORING STARTED	STARTED 11-25-86 110 D-50			JMB	ER	⊕ °/	ALIBRATE	D PENETI	ROMETER	R, TONS/F	.7
BORING COMPLET	BORING COMPLETED 11-25-86 FOREMAN B. Kollasch)		O H	NCONFINE DNS/FT²	ED COMP	PRESSIVE	STRENGT	н,
	10.100 GLEVATION			SAN	1PLE		1 2		3 •	4 5 1 1	
ATA DEP' (FT.)	DESCRIPTION OF MATERIAL			TYPE	NUMBER	10	ATER CON 20 ANDARD F	3	10 .4	· · · · · ·	0
STR			DEPTH (FT.)	PFO L	2	10					io
0.1	Dark brown sandy	topsoil. [\sqcap							
_ 3.0	Very loose brown sand.	& gray silty fine	-2.5 -	/ -	1	r					
6.0	Medium to very so	ft gray organic clay.	- 5.0 -	/	2				•		
7.0	Loose gray & blac	k silty fine sand; root	s .	/L	ן ֿ	4			•		
.		ense gray silty fine	-7.5 - -10.0-	/ /-	4	.4		2			
-12.0 - - 14.5		mottled with black ium dense gray clayey	-12.5-	/-	6	\		*			
	Medium dense gray of very stiff gra	fine sand with seams y clay.	-15.0-	1	7		7	7			
_ - - _19.5	seams of very sof	silty fine sand with t gray clay.	-17.5-	1	8		4				·
-	Very stiff to hard gray silty & sandy clay. (CL)			1	9			Z	}⊕́)	
				1	10 11					₩₩	
ļ -	WATER LEVEL WHILE DRILLING 1.5 ft. WATER LEVEL				-				STING RING		
SPL	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CO			9715 KENNEDY AVENUE HIGHLAND, INDIANA 46322							
+PL - Pl	LASTIC LIMIT +LL - L	IQUID LIMIT & & UNIT DRY WE	IGHT				EPHON				

CLIEN	T renga Engineering		1	BORING Sheet	NUMBER 2 of 2				
SITE LOCATION PROJECT									
1	fax Avenue, Griffi	th, Indiana	i i		nitary Landfill				
BORING STARTED	11-25-86	RIG D-50	FILE NU	JMBER	CALIBRATED PENETROMETER, TONS/FT.2				
BORING COMPLET	TED 11-25-86	FOREMAN _B . Kollasch	220		UNCONFINED COMPRESSIVE STRENGTH, TONS/FT ²				
E	SURFACE ELEVATION	631.84		SAMPLE	1 2 3 4 5				
STRATA DEPTH (FT.)	DESCRIPT	TION OF MATERIAL	DEPTH (FT.)	TYPE RECOVERY NUMBER	WATER CONTENT PERCENT 10 20 30 40 50 △ STANDARD PENETRATION, BLOWS/FT. 10 20 30 40 50				
	Very stiff to har clay. (CL)	rd gray silty & sandy	-27.5- -30.0-	12 13 14					
- - - - - - - - - 37.0	Gray coarse sand		-32.5- -35.0- -37.5-	15 16 17* 18					
- - - - - - - - - - - - - - - - - - -		ff gray silty sandy & fine gravel. (CL)	- 40.0-	19* 20*					
1	coarse sand (SW).	ery dense gray fine to	- 45. 0	22					
50.5	NOTE: * - Split pushed hydraulica	spoon sampler was lly to obtain sample.	50.0	24	105				
-	▼ WATER LEVEL WHILE DRILLING 1.5 ft. ▼ WATER LEVEL			K & S TESTING AND ENGINEERING INC.					
7 SPLI	SPLIT SPOON SHELBY TUBE A AUGER POCK CORE			9715 KENNEDY AVENUE					
\ _	-	QUID LIMIT . & - UNIT DRY W			HIGHLAND, INDIANA 46322 TELEPHONE: (219) 924-5231				

CLIEN	Т		LOG O	ВОГ	RING	NUMBE	R						
Torrenga Engineering				M-	2,	Sheet	1 of 3						
SITE LO	SITE LOCATION Colfax Avenue, Griffith, Indiana				ME					· · · · · · ·			
Colf	fax Avenue, Griffit	h, Indiana	Gr	iffi	th	Sanita	ry Land	Fill					
BORING STARTED	STARTED 12-9-86 D-50			JMBE	R	CAL	IBRATED PEN	ETROMETER	R, TONS/F	T,2			
BORING COMPLET	BORING COMPLETED 12-10-86 FOREMAN B. Kollasch				220 UNCONFINED COMPRESSIVE ST								
	605 3.8				PLE	1	2	3	4 :	5			
F F	EPT.				~	● WAT	ER CONTENT	PERCENT					
TA C	DESCRIPTION OF MATERIAL				IBE	10	20	30	40	50			
TRA	DESCRIPTION OF MATERIAL				NUMBER		NDARD PENET		OWS/FT.				
S				TYPE RECOVER		10	20	30	40	50			
 	Loose light brown	silty fine to medium											
١-	sand with lenses	of clayey sand.		I/\sqcup	1	4	ĺ						
3.0			2.5 -	H				}					
		& dark brown silty		1	2		Ì						
E	fine sand, trace material.	clay & brown fibrous	-5.0 -	$ar{U}$	2	4			ŀ				
5.5			- 7.0			$ \setminus $	[!			
F	Loose, dark brown	organic peat, trace		I	3	$ \lambda $							
8.0	10005.		-7.5 -	4									
r 1	Medium dense brow	n & gray fine to coarse											
- - - - -	sand, trace shale		ļ	$V \sqcup$	4	1	Θ						
F 1			-10.0-	П									
_				7	5		人						
13.0			-12.5-	4			17]				
13.0	Medium dense grav	fine to coarse sand,					V		}				
l- ⁻	trace silt & clay			I/L	6		4]	1			
 -			-15.0-						ļ	j			
				.						:			
E			-17.5-]				V		}			
F			17.5	$\{ \mid$						1			
[19.0]				1/	7			$ \Delta a $	4	ļ			
F		gray, silty, clay,trac	20.0	 	i		11	14	1.				
 	sand (CL).			1/1	8*		•		\\\\\\				
-			-22.5-	/ -	ł		1 1		ĮΨ	55			
	·				9				lф	Δ			
E								}	1				
					10:	<u> </u>		(₽	<u> </u>			
▼ WA	¥ WATER LEVEL WHILE DRILLING 11.0 ft. & 49.0 ft.						K&ST	ESTING	AND				
-	- WATER LEVEL				(ENGINE						
-				9715 KENNEDY AVENUE									
1 "	_	-					LAND, IND						
+PL.PL	ASTIC LIMIT +LL - L	IQUID LIMIT . & - UNIT DRY WI	EIGHT			TELE	PHONE: (21	9) 924-5:	231				

CLIENT LOG OF 8			F BORING NUMBER						
Torrenga Engineering			M-2, Sheet 2 of 3						
SITE LOCATION PROJECT			CT NAME						
Colfaz Avenue, Griffith, Indiana Gr			riffith Sanitary Landfill						
BORING		15.5		FILE NUMBER CALIBRATED PENETROMETER, TONS/FT.					
STARTED BORING	12-9-86	<u> </u>		UNCONFINED COMPRESSIVE STRENGS					
COMPLET	SURFACE ELEVATION	FOREMAN B. K	ollasch	22	SAMPLE	1 2		4	5
l Ha	COM NOT ELEVATION			1 1		WATER CON	TENT PERC	ENT	
4 DE	DECORIDE A	ION OF MATERIAL		Ē.		10 20	30	40	50
STRATA DEPTH (FT.)	DESCRIPT	ION OF MATERIAL		DEPTH (FT.)	TYPE RECOVERY NUMBER	△ STANDARD F	PENETRATIO	N, BLOWS/FT	
STI						10 20	30	40	50
-									
E					7				1 1
	Very stiff & hard	l gray, silty,	clay,	-27.5	/ 11*			岁	
	trace sand (CL)				12*		_ 		
E	1" and 2" seams o						(1 1
<u> </u>	noted at 39.0 ft.	\pm and 43.5 ft	. ±,	-30.0-				}	
F	respectively.				13*		•]]
 				22 5					1 1
				- 32.5-	14*			()	1 1
<u> </u>					44	7			1 1
				-35.0-	15*				1
						T		14	
E					16*			lф	1
				-37.5-		7		17	1
					17*	7		\mathcal{X}	
] -				40.0-	/ -			Ψ	
F				40.0	18*				
- '					/Lf	9] #)
<u>L</u>				42.5	19:		1 _+		
<u> </u>							🕈		
E					H			.	
-				45.0-	/ <u> </u> 20%	1 7	Ð l		
F							1		} ;
F					/ 21 *				
				47.5-		/ \			
49.0					22%	∮ ●		Ì	
-	Dense to very den sand with 1" silt	se gray fine y clay @ 50.5	to coarse ft. T.	50.0		<u> </u>			
1	₩ WATER LEVEL WHILE DRILLING 11.0 ft. & 49.0 ft. WATER LEVEL				(. 111 /		TING AN	1
- -	<u> </u>				9715 KENNEDY AVENUE				
_	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CORE				HIGHLAND, INDIANA 46322				
+PL-PLASTIC LIMIT +LL-LIQUID LIMIT . & - UNIT DRY WEIGHT				TELEPHONE: (219) 924-5231					

CLIENT LOG OF			F BORING NUMBER							
Torrenga Engineering				M-2, Sheet 3 of 3						
SITE LOCATION P			PROJEC	PROJECT NAME						
Colfax Avenue, Griffith, Indiana			Grif	Griffith Sanitary Landfill						
BORING STARTED	12-10-86	RIG D-50	FILE NU	FILE NUMBER CALIBRATED PENETROMETER, TONS/FT.2						
BORING COMPLET	TED 12-10-86	FOREMAN B. Kollasch	220			O UNCON	FINED COMP	PRESSIVE	STRENG	гн,
	SURFACE ELEVATION	635.18		SAN	IPLE					5
EPT			7	□ >		● WATER	CONTENT PE	RCENT		
ra D FT.)	DESCRIPT	TION OF MATERIAL	DEPTH (FT.)	YPE	BE	10	20 3	10 4	10	50
STRATA DEPTH (FT.)			DE (F	TYPE	NUMBER	△ STANDA	RD PENETRA	TION, BLO	OWS/FT.	
S			ļ <u>.</u>	ď	_	10	20 ;	30	40	50
-				И	23		İ			^
F				/	1		j			712
}	Danca to yony do	nse gray fine to coarse	52.5	П						
F		ty clay @ 50.5 ft. \pm		7	24					
L				$V\vdash$	4				$ \Delta $	
55.0			55.0	Н						
FI	THE OF BOLLIA									
 	END OF BORING						:			
	-				1					
<u> -</u>										
						<u> </u>		}		
- - - -	NOTE: # - The s	plit spoon sampler				1	İ			
E		ulically to obtain								
F	samples.		-							
I-									İ	ļ
r-						!	İ			
-										I
<u> </u>							- 1			
F				1		1				
F										
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<u> </u>					1			<u> </u>	<u> </u>	
7	WATER LEVEL WHILE DRILLING 11.0 ft. & 49.0 ft.				(L ITE J	(&STE			
▼ WA	▼ WATER LEVEL				ENGINEERING INC.					
SPLIT SPOON SHELBY TUBE A AUGER Z ROCK CORE				9715 KENNEDY AVENUE HIGHLAND, INDIANA 46322						
+PL·PL	+PL · PLASTIC LIMIT +LL · LIQUID LIMIT & · UNIT DRY WEIGHT				TELEPHONE: (219) 924-5231					

CLIENT LOG OF			OG OF BORING NUMBER									
Torrenga Engineering M-			M-3, Sheet 1 of 2									
SITE LOCATION PROJE				PROJEC	PROJECT NAME							
Colfax Avenue, Griffith, Indiana Gr			Gri	Griffith Sanitary Landfill								
BORING STARTED	12-8-86	RIG D-50		FILE NU	FILE NUMBER CALIBRATED PENETROMETER, TONS/FT. ²							Τ.²
BORING COMPLET	ED 12-8-86	FOREMAN B. Ko	llasch	220			0 %	ICONFINI NS/FT²	ED COMP	RESSIVE	STRENGT	Ή.
E	SURFACE ELEVATION	630.25		Ş	SAM	PLE	1	2	3 	· ·	\$ 5 	·
STRATA DEPTH (FT.)					>	~	● WA	TER CON	TENT PE	RCENT	. –	
ra D (FT.)	DESCRIPTI	ON OF MATERIAL		DEPTH (FT.)	TYPE RECOVERY	NUMBER	10	20	3	0 4	0 5	50
RA				DE (F		NO!	△ STA	NDARD F	PENETRA	TION, BLO	WS/FT.	ŀ
S					12	_	10	20) 3 	0 4	0 5	50
-	Very loose black	& dark brown s	ilty							1	1	
-	fine sand, trace	roots.				1	Δ					
_ 3.0				_2.5 _	44							
_ 3.0	Medium dense gray	fine to coars	e sand,		4							
_	trace silt & root		,		/	2	2	4			}	•
<u> </u>				- 5.0 - ∤	47			\setminus				Ì
_					╌			$ \setminus $				
_	Medium dense gray trace shale & fin		e sand,		/	3		4			į	ŀ
_	crace shale & iin	e graver.		-7.5 -				$ \ \ $				
-						,		lλ				
_	· 			-10.0		4		1 4	7			
-				10.0								
- -12.0					7	5		$\oplus \bullet$				
				— 12.5 —	4			7	,	·		
_	Stiff to very sti sandy clay or sa				T				,		.	
_	(CL-ML).	ndy and crayey	SIIC.		$/\!\!\mid \! \mid$	6			∇) À)	
-	,			- 15.0-						/		
-						7*			4		, ,	
- - 17.5) -			
- 1/·J	Very stiff & hard	grav silty cl	av.	17.5-	$/\!\!1$	8*			4			
_	trace shale & fin		u,					7	Ψ			
				20.0		9*		🚣		`\ <u>\</u>	7	
_					/Ц	ĺ .		١٣١		. 4		
_					7						1	
_				-22.5-	/	10%					Ψ	
23.0	Hard gray silty cl	lay, trace shal	.e& gravel		Ŧ						0	
24.0	Dense gray coarse			25.0	/[]	11*		}				
10/0			2024,6	[23.U]		ا		<u> </u>		<u></u>	لحرجيك	
						(STING		1
¥ WA	WATER LEVEL				ENGINEERING INC.							
SPLIT SPOON SHELBY TUBE A AUGER ROCK CORE				ORE	9715 KENNEDY AVENUE HIGHLAND, INDIANA 46322							
+PL·PL	+PL - PLASTIC LIMIT +LL - LIQUID LIMIT & UNIT DRY WEIGHT				TELEPHONE: (219) 924-5231							

CLIENT LOG OF			OF BORING NUMBER						
Torrenga Engineering M-3,			B, Sheet 2 of 2						
			ROJECT NAME						
Colfax Avenue, Griffith, Indiana Grif			Griffith Sanitary Landfill						
BORING STARTED	12-8-86	RIG ₽-50	FILE NU	MBER	CALIBRA	TED PENETF	ROMETER, 1	rons/ft.²	
BORING COMPLET	ED 12-8-86	FOREMAN B. Kollasch	220		O UNCONF	NED COMP	RESSIVE ST	FRENGTH	. [
	SURFACE ELEVATION	630.25		SAMPLE		2 3		5	
STRATA DEPTH (FT.)	DESCRIPT	ION OF MATERIAL	DEPTH (FT.)	RECOVERY NUMBER	10	ONTENT PER 20 30 D PENETRAT	O 40	/S/FT.	
31.0	Dense gray coarse gravel.	e sand, trace shale &	_27.5_	12 13 14					
-	-	olit spoon sampler ulically to obtain							
▼ WA	₩ATER LEVEL WHILE DRILLING 3.0 ft. WATER LEVEL				K & S TESTING AND ENGINEERING INC.				
1	SPLIT SPOON SHELBY TUBE A AUGER ORE +PL - PLASTIC LIMIT +LL - LIQUID LIMIT &			HIGHLAND, INDIANA 46322 TELEPHONE: (219) 924-5231					

CLIENT			LOG OF	LOG OF BORING NUMBER							
Torrenga Engineering			M-4, Sheet 1 of 2								
SITE LOCATION F			PROJE	PROJECT NAME							
Colfax Avenue, Griffith, Indiana			Gri	Griffith Sanitary Landfill						ľ	
BORING STARTED	12-3-86	RIG D-50	FILE NU	FILE NUMBER CALIBRATED PENETROMETE					ROMETER	, TONS/FT	7
BORING COMPLET	reD 12-3-86	FOREMAN B. Kollasch	220)		O 50	CONFINE	ED COMP	RESSIVE	STRENGTI	н,
Ξ	SURFACE ELEVATION	633.50		SAM	PLE	<u>'</u>	2	3		4 5	
DEP.			_	l l≿	<u>_</u>			TENT PER			
STRATA DEPTH (FT.)	DESCRIPTI	ON OF MATERIAL	DEPTH (FT.)	TYPE RECOVERY	NUMBER	10		ــــــــــــــــــــــــــــــــــــــ		ــــــــــــــــــــــــــــــــــــــ	0
STR/			=	H C	Į	I SIA			TION, BLO		io
			<u> </u>			<u>'</u>		اً ا		اً ا	"
F		brown & gray silty			١.					i	Ì
_	fine sand, trace	roots.	-2.5 -	U–	1	4	7		1		
F ^{3.0}			72.3								
-	Loose gray silty oily smell noted.	sand, trace roots,		1/	2						- }
<u> </u>	dary omerr noted.		-5.0 -	Ц		7					
5.5	Modium dongo gray	coarse sand & fine									1
-	gravel.	coarse sand & rine	7.5	! / _	3		\mathcal{A}				
-				П							
9.0				1	4			λ			
- -9.0 - - -	Medium dense gray	silty fine sand, with	_10.0_	H	1						
F	lenses of gray si			₩	5					1	
_ [2.5			12.5	! / -		4					ł
I 3.0	Very stiff gray m	ottled black silty clay		₩	ł		`				
			<u> </u>	1/L	6			$\mid Z \mid$	7	🕈	
	trace sand (CL).	d with brown silty clay	15.0	<u> </u>							
F					/					Ψ	
E			17.5	\mathbf{H}	1						i
F			17.5-	1/1	8		•		4	A	
I9.0	Medium dense gra	v olavov cilt		/ =	1		7				
	Incurain dense gra	y clayey silt.	-20.0-	 /	9					1	
F		lay, trace shale &		 	1					Φ	
F	fine gravel.		22.5	1/1	10:	4	•			\Box	
23.0				¥⊨	1			AS			
	Stiff gray silty of fine gravel.	clay, trace shale &	25.0		11;		•	Ψ			
▼ WA	ATER LEVEL WHILE DRILLI	NG 3.0 ft., 37.5 ft. &	45.0 f			AD	КЯ	STE	STING	AND	
1 -	▼ WATER LEVEL				1				RING		
-					9715 KENNEDY AVENUE						
1				HIGHLAND, INDIANA 46322							
FFE. PL	+PL - PLASTIC LIMIT +LL - LIQUID LIMIT & & - UNIT DRY WEIGHT			TELEPHONE: (219) 924-5231							

CLIENT	 T		I OG OF	BO	DINI	G NUMBER			
Torrenga Engineering						sheet 2 of 2			
				PROJECT NAME					
	ax Avenue, Griffith	n, Indiana	Griffith Sanitary Landfill						
BORING STARTED	12-3-86	RIG D-50	FILE NU	ІМВІ	ER	CALIBRATED PENETROMETER, TONS/FT.2			
BORING COMPLET		FOREMAN B. Kollasch	220)		UNCONFINED COMPRESSIVE STRENGTH,			
	SURFACE ELEVATION	633.50		SAM	1PLE				
EPT] :			WATER CONTENT PERCENT			
A D FT.)	DESCRIPTI	ION OF MATERIAL	DEPTH (FT.)	EB CE	H	10 20 30 40 50			
STRATA DEPTH (FT.)			DE (F	TYPE RECOVERY	NUMBER	△ STANDARD PENETRATION, BLOWS/FT.			
S				18	_	10 20 30 40 50			
E	Very stiff gray	silty clay, trace shale		1/	12				
F.		th lenses of silt.		<u>/</u> _	1	1 1 71 4 1 1			
_			-27.5-	/	13:				
_				VL	1,3,	~ ~ ~ ~			
F			30.0	\mathcal{T}	14:				
F.,			-30.0-	VL] 7				
31.0	· · · · · · · · · · · · · · · · · · ·	clay, trace shale &			1				
33.0	fine gravel.	oray, crace share a	-32.5	//_	15	* ▼ ⊕			
- 33.0				1	1				
<u> </u>	Very stiff gray silty clay, trace shale & fine gravel with seam of fine sand @ 37.0 ft.			//	16.	*			
				 	1_]			
<u>-</u>	@ 37.0 It.			//_	177	<i>*</i>			
37.5			37.5		1	64			
E		fine to coarse sand,		//	18				
.39.0	trace shale & fi	ne to medium gravel.	-	 	1				
F 1		silty clay, trace	_40.0_	I/ -	19				
F	shale & fine gra	.vel.		/					
				/					
			-42.5-	4	20:				
		,		I/I	217				
45.0			45.0						
	Medium dense gra	y fine to coarse gravel		И	22				
F	ly sand (SP).			/ -	j				
F			47.5	1/	23				
 		·		V L	_				
F				17	24				
51.0	VATER LEVEL WHILE DRILLING END OF BORING								
-	3.0 ft., 3/.5 ft., & 45.0 ft.								
[7] SPLI	SPLIT SPOON SHELBY TUBE A AUGER Z ROCK COR				9715 KENNEDY AVENUE				
+PL-PLASTIC LIMIT +LL-LIQUID LIMIT & UNIT DRY WEIGHT				11101121115, 1115//11/140022					
	TPL-PLASTIC LIMIT TEL-LIQUID LIMIT				TELEPHONE: (219) 924-5231				

SOIL TEST DATA

PROJECT Griffith Landf	city or	COUNTY Griffith	, IN
LAB NO.	220-1	220-2	220-3
LOCATION	3" Shelby tube 3' South of Boring6	3" Shelby tube 5' SE of Boring 6	Boring 6
DEPTH (feet)	0.0 - 1.5	0.0 - 1.5	5.5 - 7.0
GRAIN SIZE CLASSIFICATN	Gray silty clay (CL)	Gray silty clay (CL)	Gray silty clay (CL)
PASSING 1" SIEVE %	·		
3/4" " %			
1/2" " %			
No 4 " %	100.0	100.0	100.0
No 10 " %	99.2	99.2	99.3
No 40 " %	95.7	95.7	96.2
No 100 " %	92.9	92.9	93.1
No 200 " %	90.8	90.8	90.2
GRAVEL %			
SAND %	9.0	9.0	10.0
FINES (silt & clay) %	91.0	91.0	90.0
LIQUID LIMIT %	32.0	32.0	31.0
PLASTIC LIMIT %	19.0	19.0	17.0
PLASTICITY INDEX %	13.0	13.0	14.0
DRY DENSITY PCF	116.2	107.1	
PROCTOR DENSITY PCF			
OPTIMUM MOISTURE %			
PERCENT DENSITY %			
COEFF. OF PERMEABL cm/s	ec 2.1 x 10 ⁻⁸	2.4 x 10 ⁻⁸	

REMARKS:

LAB NO.	220-4	220-5	
LOCATION	Boring ⁷	Boring 8	
DEPTH	16.0 - 17.5	21.0 - 23.0	
GRAIN SIZE CLASSIFICAT	N Gray silty clay (CL)	Gray silty clay	
PASSING 1" SIEVE %			
3/4" " %			
1/2" " %	100.0	100.0	
No 4 " %	99.2	99.5	
No 10 " %	98.6	98.3	
No 40 " %	96.2	96.3	
No 100 " %	92.8	93.5	
No 200 " %	90.7	91.5	
GRAVEL %	1.0	1.0	
SAND %	8.0	8.0	
TINES (silt & clay) %	91.0	91.0	
LIQUID LIMIT %	31.0	29.0	
PLASTIC LIMIT %	19.0	17.0	
PLASTICITY INDEX %	12.0	12.0	
DRY DENSITY PCF			·
PROCTOR DENSITY PCF			
OPTIMUM MOISTURE %			
PERCENT DENSITY %			

PROJECT Griffith Lands	CITY OR	COUNTY Griffith,	Indiana
LAB NO.	220-6	220-7	220-8
LOCATION	Monitoring Well	Monitoring Well	Monitoring Well
	No. 1	No. 1	No. 1
DEPTH (feet)	21.5-25.5	41.5-44.5	45.5-47.5
GRAIN SIZE CLASSIFICATN	Gray silty & sandy clay (CL)	Gray silty & sandy clay, trace gravel (CL)	Gray fine to coarse sand (SW)
PASSING 1" SIEVE %			
3/4" " %		100.0	
1/2" " %	100.0	98.1	100.0
No 4 " %	99.6	97.6	99.6
No 10 " %	93.7	94.1	78.4
No 40 " %	92.0	92.5	18.9
No 100 " %	89.0	87.7	4.7
No 200 " %	83.8	80.8	0.8
GRAVEL %		3.0	
SAND %	17.0	17.0	99.0
INES (silt & clay) %	83.0	80.0	1.0
LIQUID LIMIT %	30.0	27.0	
PLASTIC LIMIT %	21.0	15.0	
PLASTICITY INDEX %	9.0	12.0	
DRY DENSITY PCF			·
PROCTOR DENSITY PCF			
OPTIMUM MOISTURE %			
PERCENT DENSITY %			
COEFF. OF PERMEABL cm/se	c		

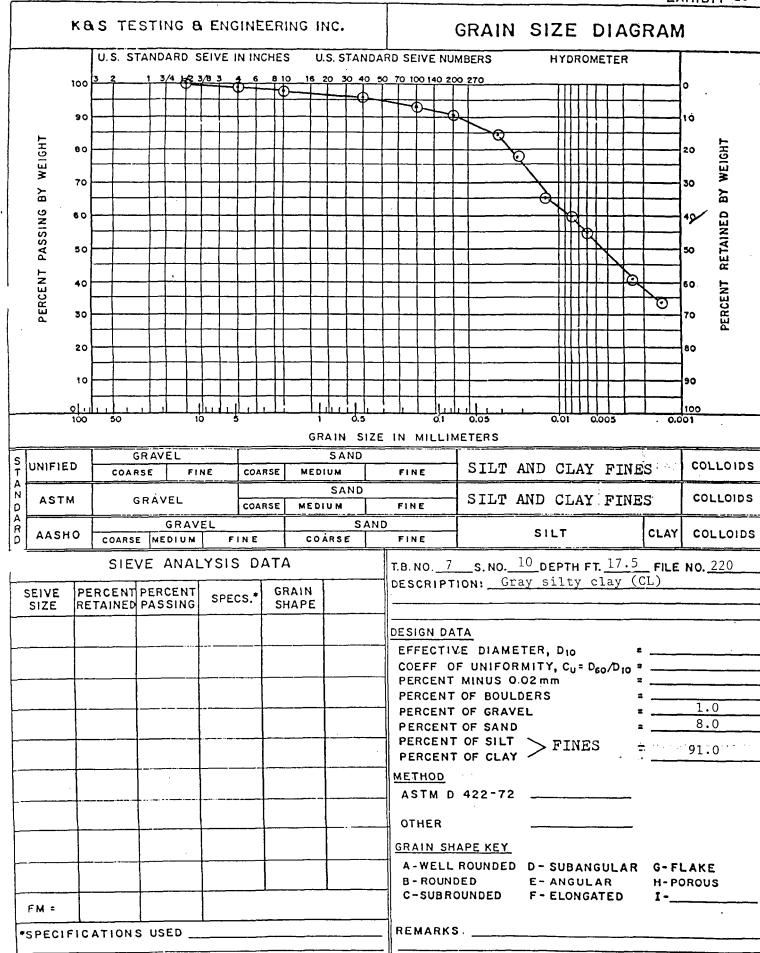
PROJECT Griffith Landfill	CITY OR	COUNTY Griffith.	Indiana
LAB NO.	220-9	220-10	220-11
LOCATION	Monitoring Well	Monitoring Well	Monitoring Well
_	No. 2	No. 3	No. 4
DEPTH (feet)	28.0 - 30.0	15.0 - 17.0	11.0 - 15.0
GRAIN SIZE CLASSIFICATN	Gray silty clay trace sand (CL)	Gray silty & sandy clay or sandy & clayey silt(CL-ML)	Gray silty clay trace sand (CL)
PASSING 1" SIEVE %	·		
3/4" " %			
1/2" " %		100.0	
No 4 " %	99.6	99.0	100.0
No 10 " %	98.6	98.1	99.6
No 40 " %	96.2	92.5	96.4
No 100 " %	92.9	79.0	90.8
No 200 " %	90.7	72.0	89.2
GRAVEL %		1.0	
SAND %	9.0	27.0	11.0
'INES (silt & clay) %	91.0	72.0	89.0
LIQUID LIMIT %	31.0	20.0	35.0
PLASTIC LIMIT %	18.0	14.0	18.0
PLASTICITY INDEX %	13.0	7.0	17.0
DRY DENSITY PCF	115.3	121.9	
PROCTOR DENSITY PCF			
OPTIMUM MOISTURE %			
PERCENT DENSITY %			
COEFF. OF PERMEABL em/se	c 1.6 x 10 ⁻⁸	1.4 x 10 ⁻⁶	

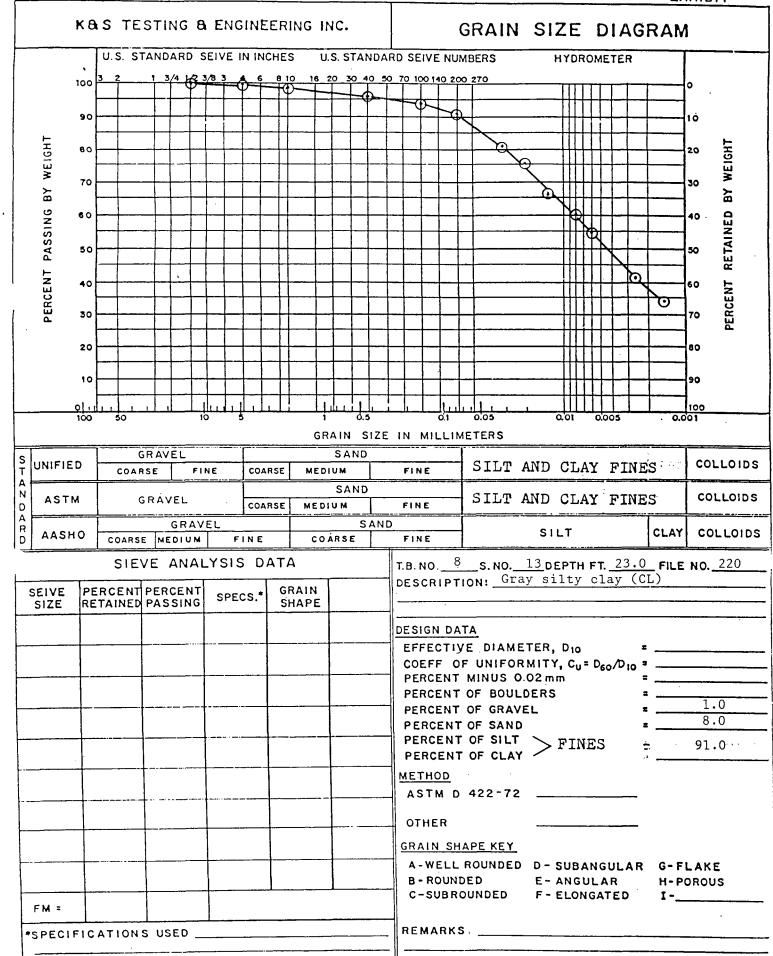
PROJECT Griffith Landf	ill CITY OR	COUNTY Griffith	Indiana
LAB NO.	220-12	220-13	
LOCATION	Monitoring Well	Monitoring Well	
	No. 4	No. 4	
DEPTH (feet)	15.0 - 16.5	45.0 - 47.0	<u>.</u>
GRAIN SIZE CLASSIFICATN	Gray silty clay trace sand (CL)	Gray fine to coarse gravely sand (SP)	
PASSING 1" SIEVE %			
3/4" " %			
1/2" " %	100.0	100.0	
No 4 " %	99.9	87.2	
No 10 " %	98.8	60.6	
No 40 " %	96.6	20.0	
No 100 " %	93.9	6.5	
No 200 " %	92.3	4.7	
GRAVEL %		13.0	· · · · · · · · · · · · · · · · · · ·
SAND %	8.0	82.0	
TNES (silt & clay) %	92.0	5.0	
LIQUID LIMIT %	28.0		
PLASTIC LIMIT %	16.0		
PLASTICITY INDEX %	12.0		
DRY DENSITY PCF	121.0	·	·
PROCTOR DENSITY PCF			·
OPTIMUM MOISTURE %			-
PERCENT DENSITY %	<u> </u>		
COEFF. OF PERMEABL cm/se	c 1.9 x 10 ⁻⁸		

K&S TESTING & ENGINEERING INC. GRAIN SIZE DIAGRAM U.S. STANDARD SEIVE IN INCHES U.S. STANDARD SEIVE NUMBERS HYDROMETER 16 20 30 40 50 70 100 140 200 270 100 90 10 PERCENT RETAINED BY WEIGHT 80 20 70 ВХ PASSING 60 50 40 Ø 30 70 20 10 0.01 0.005 0.001 GRAIN SIZE IN MILLIMETERS GRAVEL SAND UNIFIED COLLOIDS SILT AND CLAY FINES FINE COARSE FINE COARSE MEDIUM SAND COLLOIDS ASTM GRAVEL SILT AND CLAY FINES COARSE FINE MEDIUM D GRAVEL SAND SILT CLAY COLLOIDS AASHO COARSE MEDIUM FINE COARSE FINE Near SIEVE ANALYSIS DATA T.B. NO. _6 __ S. NO. <u>ST#2</u>DEPTH FT. <u>1.5 __</u> FILE NO. <u>220</u> DESCRIPTION: Gray silty clay (CL) PERCENT PERCENT RETAINED PASSING GRAIN SEIVE SPECS.* SHAPE DESIGN DATA EFFECTIVE DIAMETER, D10 COEFF OF UNIFORMITY, Cu = D60/D10 = ___ PERCENT MINUS 0.02 mm PERCENT OF BOULDERS PERCENT OF GRAVEL PERCENT OF SAND PERCENT OF CLAY > FINES 91.0 METHOD ASTM D 422-72 _____ OTHER GRAIN SHAPE KEY A-WELL ROUNDED D-SUBANGULAR G-FLAKE B - ROUNDED E-ANGULAR H-POROUS C-SUBROUNDED F - ELONGATED

REMARKS ____

*SPECIFICATIONS USED _



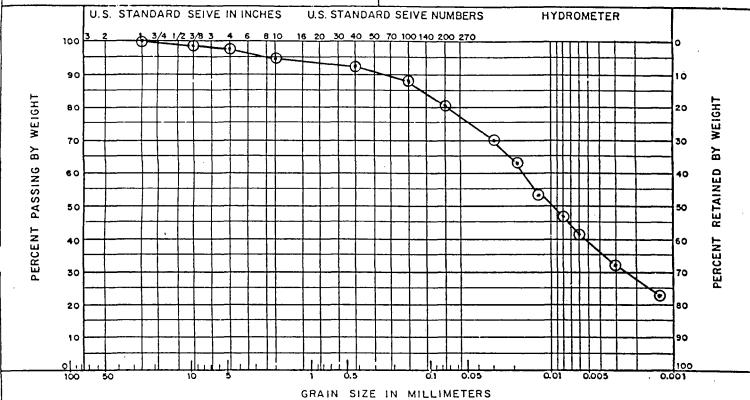


REMARKS ___

*SPECIFICATIONS USED

KAS TESTING & ENGINEERING INC.

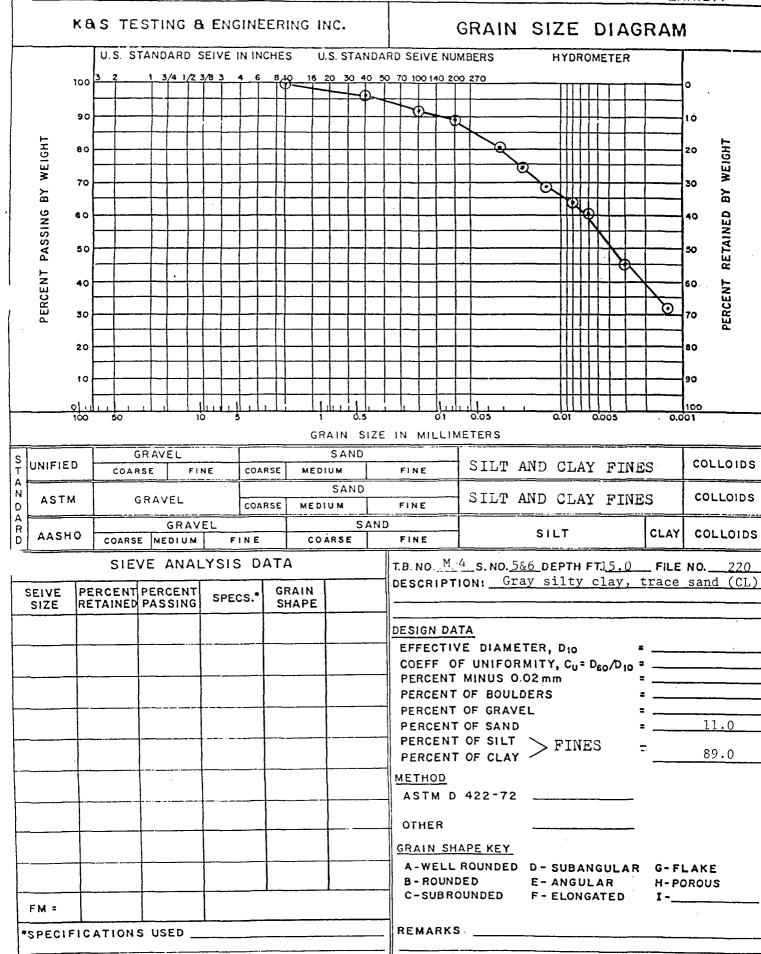
GRAIN SIZE DIAGRAM



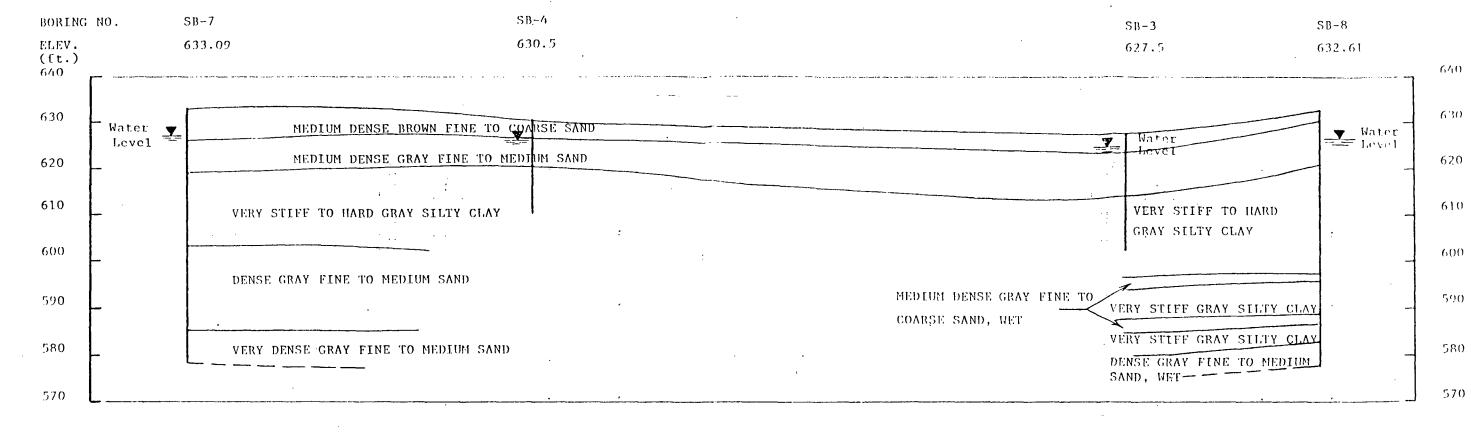
S	UNIFIED	GRAVEL			SAND			00110120
Ť	UNIFIED	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY FINES	COLLOIDS
N N	40714				SAND		SILT AND CLAY FINES	COLLOIDS
D	ASTM	GRAV	E L	COARSE	MEDIUM	FINE	SILT AND CLAI FINES	COLLOIDS
I A		GRAVEL			SAND		SILT CLA	× 0011010
D	AASHO	COARSE ME	DIUM	FINE	COARSE	FINE	SILT CLA	Y COLLOIDS

	SIE	VE ANAL	YSIS DA	ATA	T.B. NO. M 1 S. NO. 21		
SEIVE	PERCENT RETAINED		SPECS.*	GRAIN SHAPE	DESCRIPTION: Gra gravel (CL)	ly silty & sand	y clay, trace
FM =	TICATIONS				DESIGN DATA EFFECTIVE DIAMETOPERCENT OF UNIFORM PERCENT OF BOULD PERCENT OF GRAVE PERCENT OF SAND PERCENT OF SILT PERCENT OF CLAY METHOD ASTM D 422-72 OTHER GRAIN SHAPE KEY A-WELL ROUNDED B-ROUNDED C-SUBROUNDED REMARKS	D-SUBANGULAR	3.0 17.0 80.0

KAS TESTING & ENGINEERING INC. GRAIN SIZE DIAGRAM U.S. STANDARD SEIVE IN INCHES U.S. STANDARD SEIVE NUMBERS HYDROMETER 100 90 10 WEIGHT 80 70 30 В PERCENT PASSING 60 50 50 40 60 30 70 \odot 20 80 10 GRAIN SIZE IN MILLIMETERS GRAVEL SAND COLLOIDS UNIFIED SILT AND CLAY FINES COARSE FINE COARSE MEDIUM FINE SAND SILT AND CLAY FINES COLLOIDS **ASTM** GRÁVEL COARSE MEDIUM FINE D SAND GRAVEL COLLOIDS SILT CLAY AASHO COARSE MEDIUM FINE COÁRSE FINE SIEVE ANALYSIS DATA T.B. NO. M 2 S. NO. 12 DEPTH FT. 30.0 FILE NO. 220 DESCRIPTION: Gray silty clay, trace sand (CL) PERCENT PERCENT GRAIN SEIVE SPECS.* RETAINED PASSING SHAPE SIZE DESIGN DATA EFFECTIVE DIAMETER, DIO COEFF OF UNIFORMITY, Cu= D60/D10 = . PERCENT MINUS 0.02 mm PERCENT OF BOULDERS PERCENT OF GRAVEL 9.0 PERCENT OF SAND PERCENT OF CLAY > FINES 91.0 METHOD ASTM D 422-72 __ OTHER GRAIN SHAPE KEY A-WELL ROUNDED D-SUBANGULAR G-FLAKE B - ROUNDED E-ANGULAR H-POROUS C-SUBROUNDED F - ELONGATED REMARKS: *SPECIFICATIONS USED _



K&S TESTING & ENGINEERING INC. GRAIN SIZE DIAGRAM U.S. STANDARD SEIVE IN INCHES U.S. STANDARD SEIVE NUMBERS HYDROMETER 16 20 30 40 50 70 100 140 200 270 100 90 1Ó BY WEIGHT 80 70 PASSING 60 50 40 30 70 20 80 0.01 GRAIN SIZE IN MILLIMETERS GRAVEL SAND UNIFIED COLLOIDS SILT AND CLAY FINES COARSE FINE COARSE MEDIUM FINE SAND Ν COLLOIDS SILT AND CLAY FINES **ASTM** GRAVEL COARSE MEDIUM FINE D GRAVEL SAND SILT CLAY COLLOIDS AASHO COARSE MEDIUM FINE COÁRSE FINE SIEVE ANALYSIS DATA T.B. NO. M 4 S. NO. 22 DEPTH FT. 47.0 FILE NO. 220 DESCRIPTION: Gray fine to coarse gravely PERCENT PERCENT GRAIN SEIVE sand (SP) SPECS.* RETAINED PASSING SHAPE SIZE DESIGN DATA EFFECTIVE DIAMETER, D10 COEFF OF UNIFORMITY, Cu = D60/D10 = -PERCENT MINUS 0.02 mm PERCENT OF BOULDERS 13.0 PERCENT OF GRAVEL 82.0 PERCENT OF SAND percent of clay > FINES 5.0 METHOD ASTM D 422-72 _____ OTHER GRAIN SHAPE KEY A-WELL ROUNDED D-SUBANGULAR G-FLAKE B - ROUNDED E-ANGULAR H-POROUS C-SUBROUNDED F - ELONGATED *SPECIFICATIONS USED __ REMARKS .__



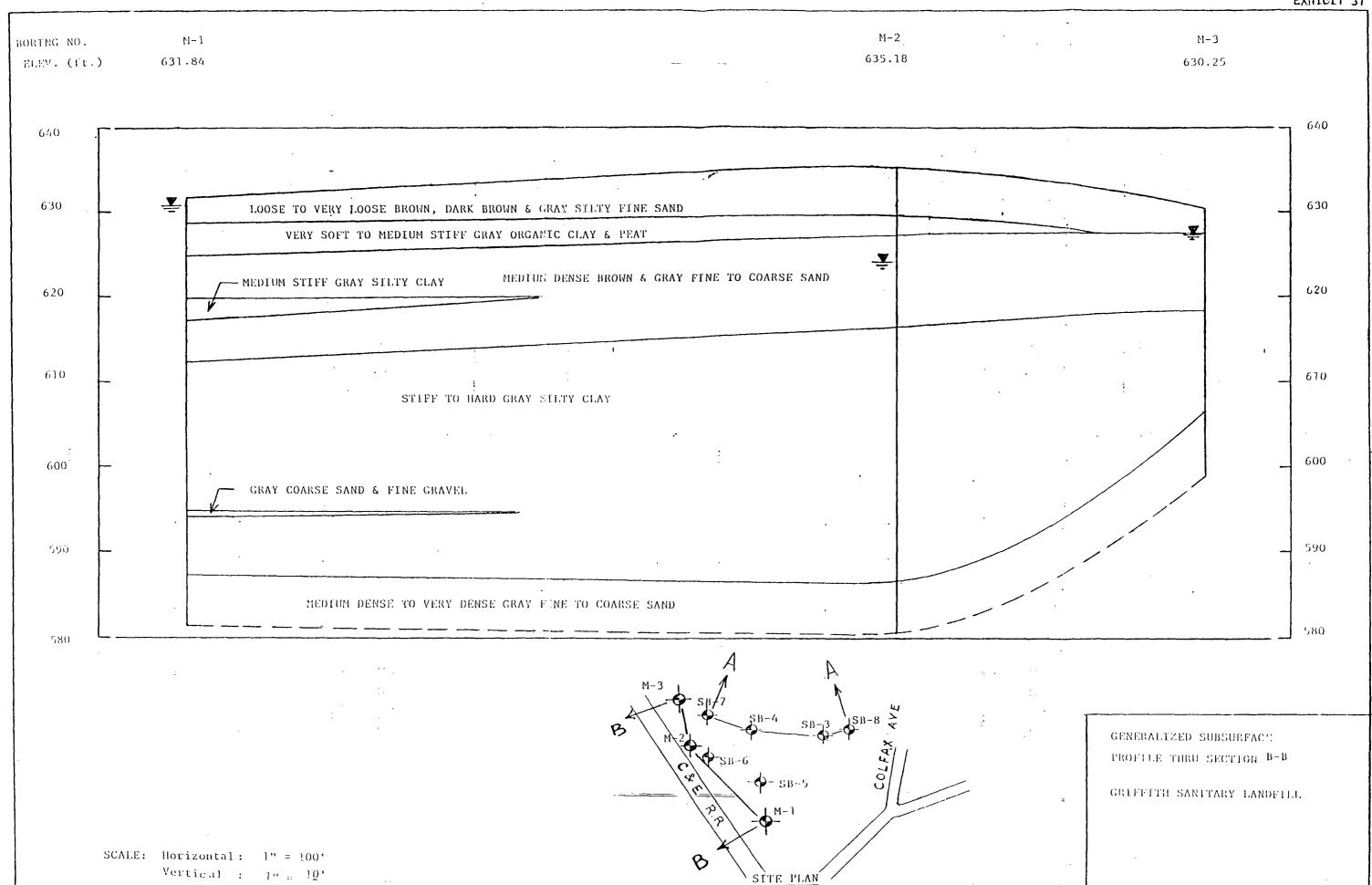
SCALE

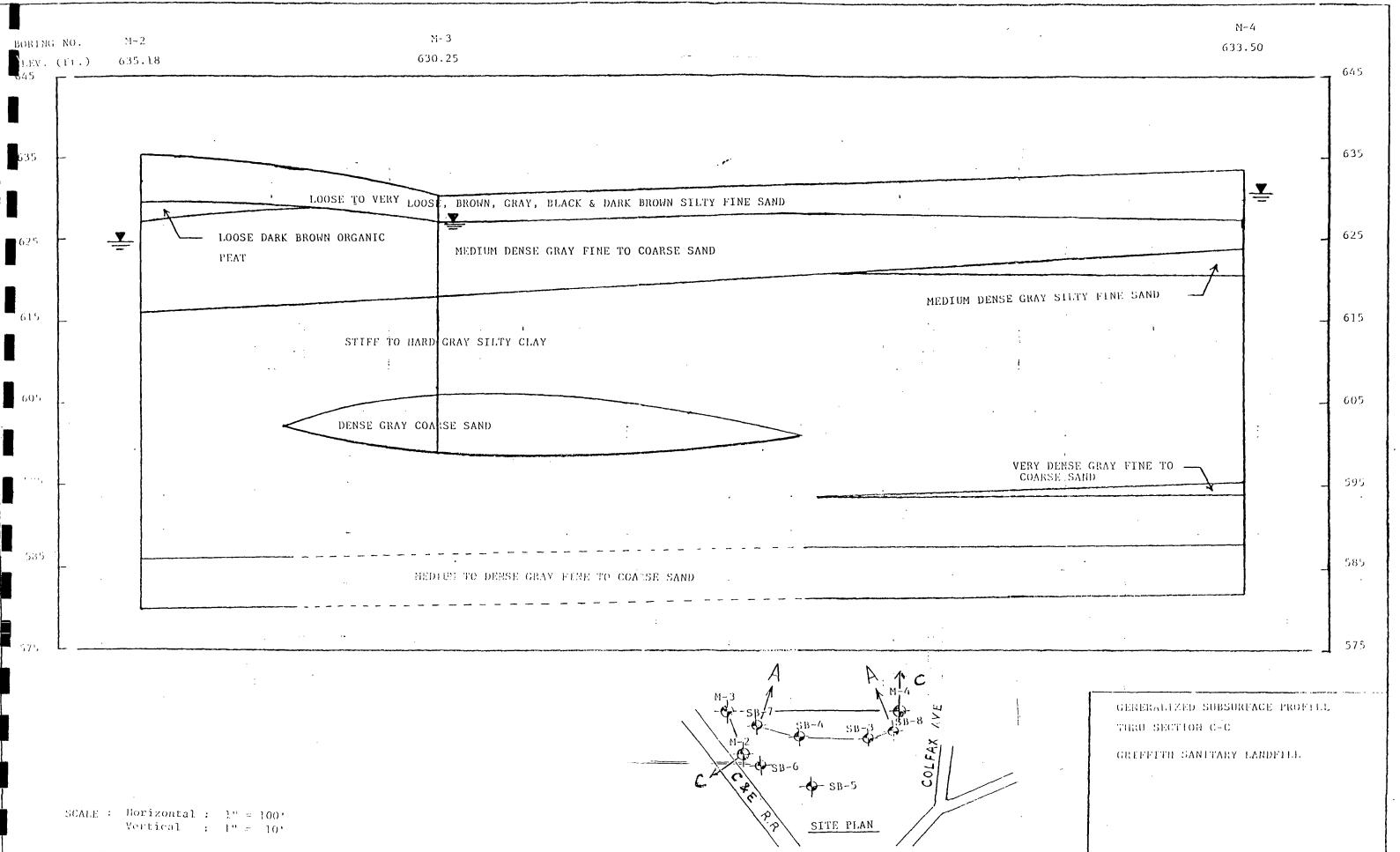
HORIZONTAL: 1" = 75'

VERTICAL: 1" = 201

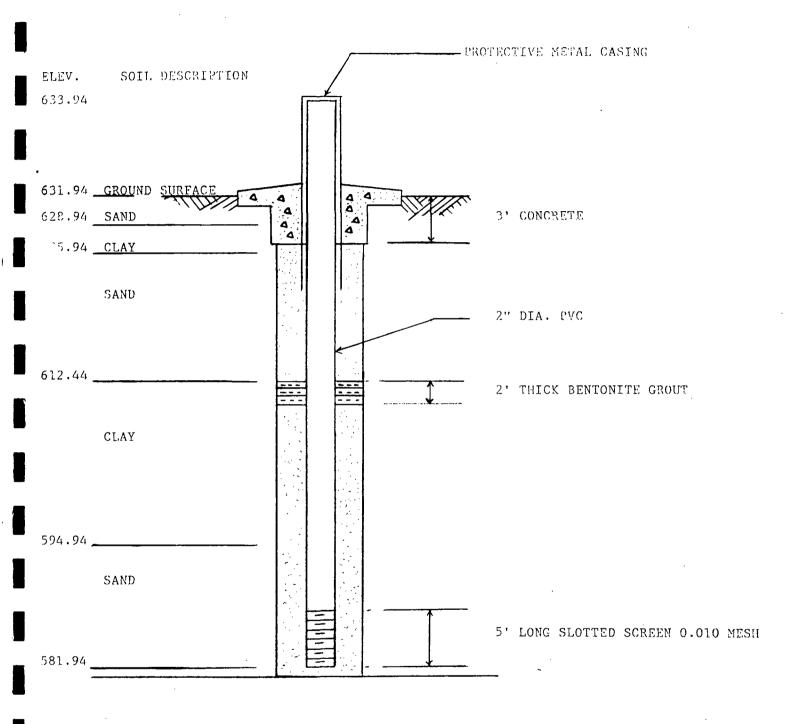
SITE PLAN

GENERALIZED SUBSURFACE PROFILE THRU SECTION A-A GRIFFITH SANITARY LARDFILL





DETAILS OF MONITORING WELL MAD





CONCRETE



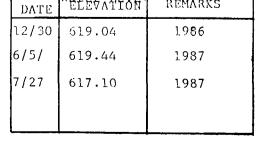
BENTONITE



GRANULAR BACKFILL



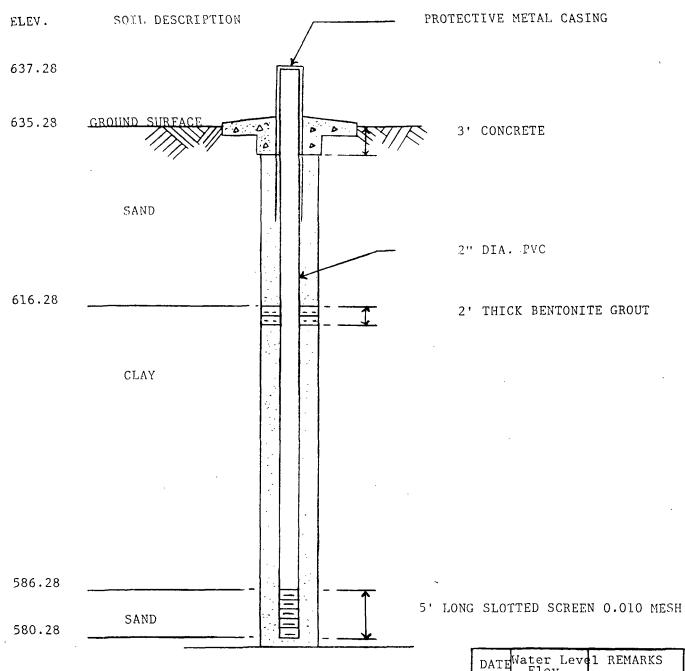
WELL SCREEN



REMARKS

neferyteru,

DETAILS OF MONITORING WELL M-2





CONCRETE



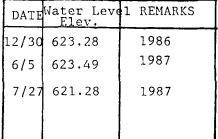
BENTONITE



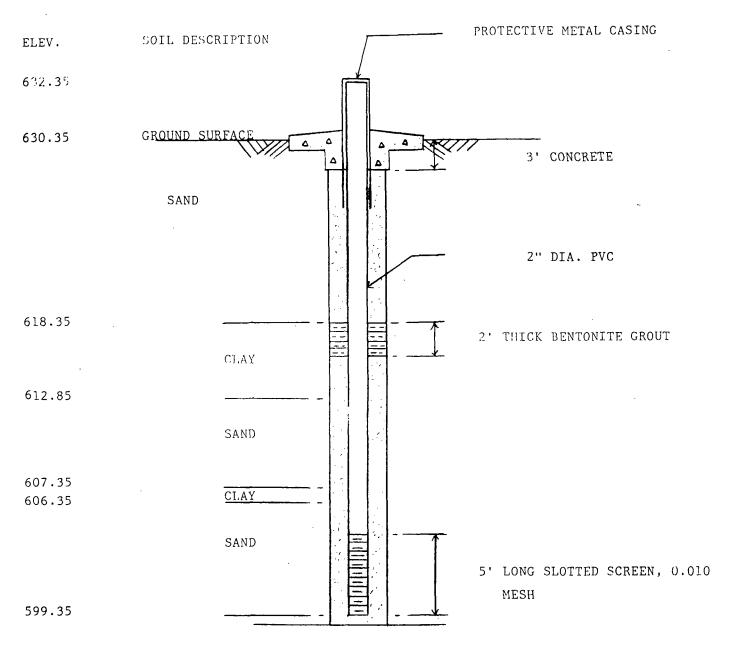
GRANULAR BACKFILL



WELL SCREEN



DETAILS OF MONITORING WELL M-3





CONCRETE



BENTONITE



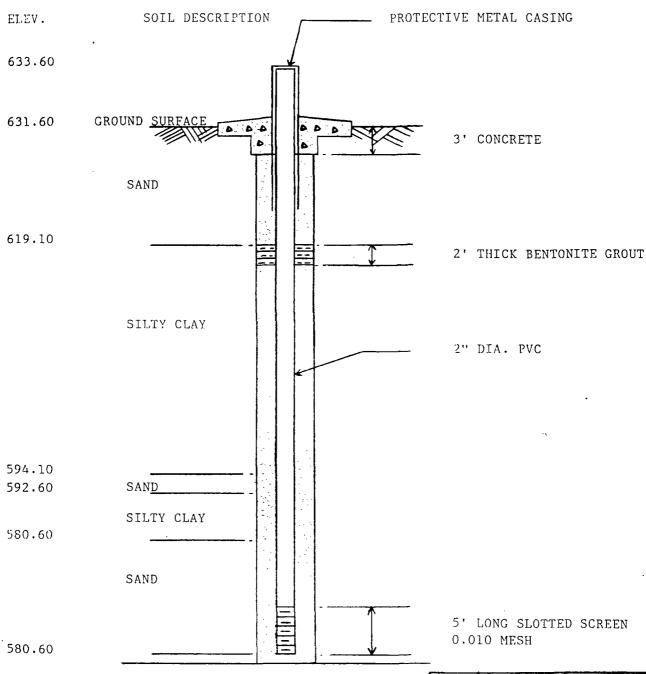
GRANULAR BACKFILL



WELL SCREEN

DATE	Water Level Elv.	REMARKS
12/30	623.17	1986
6/5	623.35	1987
7/27	621.10	1987

DETAILS OF MONITORING WELL M-4



DATE

12/30

6/5

7/27

Water Level Elv.

623.34

623.68

621.40

REMARKS

1986

1987

1987



CONCRETE



BENTONITE



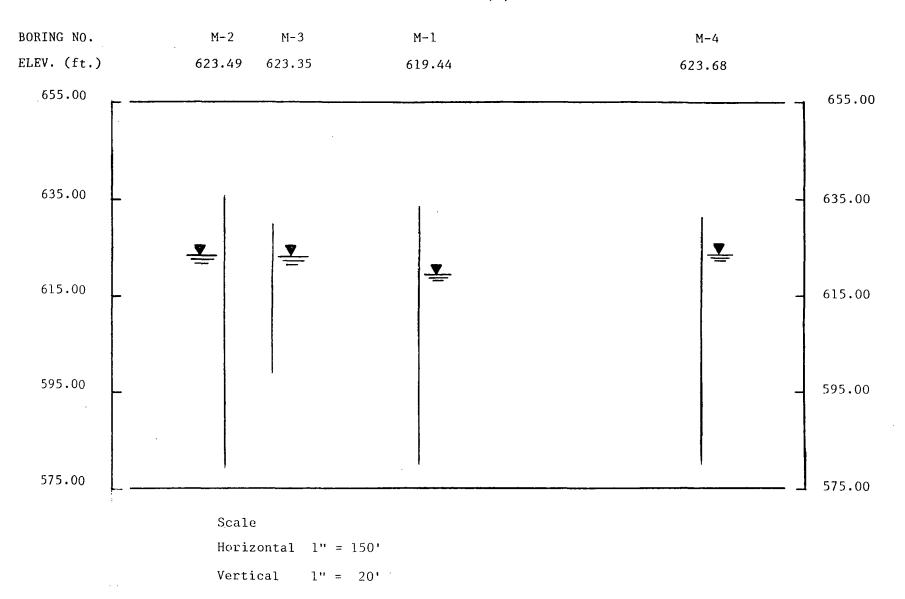
GRANULAR BACKFILL

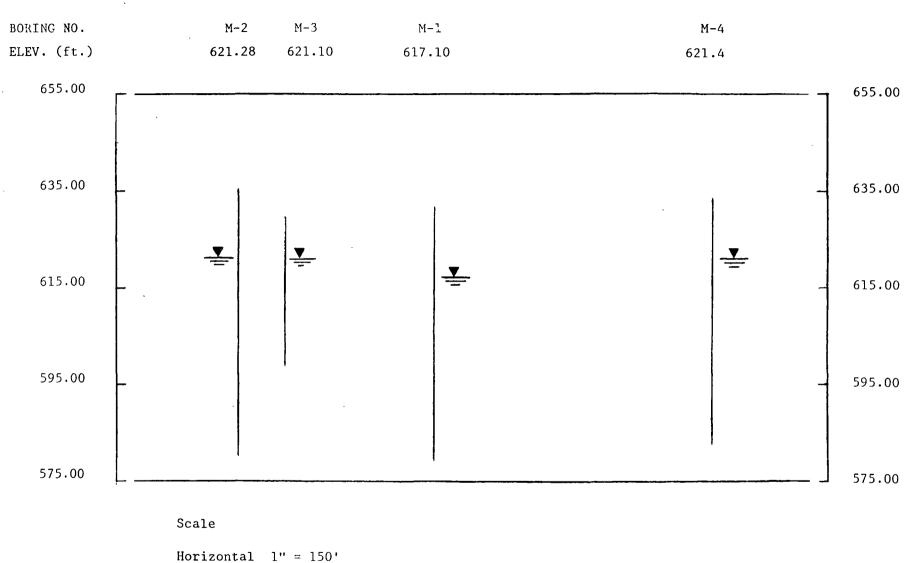


WELL SCREEN

Horizontal 1" = 150'

Vertical 1" = 20'





Vertical

1" = 20'



ANALYTICAL REPORT

TO: K & S Testing & Engineering

3623 43rd Street Highland In 46322

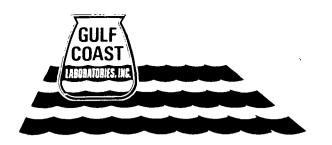
ATTN: Mr. Dibakar Sundi

DATE: 06/29/87

RE: Griffith Landfill

Field Blank

GCL #	PARAMETERS	ANALYST		RESUL:	rs
107072	Chemical Oxygen Demand Dissolved	sah	<	5	mg/l
	Chlorides, Dissolved	lam	<	1	mg/l
107072	Hardness, Dissolved	el	<	10	mg/l
107072	Iron, Total	el	<	0.030	mg/l
107072	Solids, Total Dissolved	bt	<	10	mg/l
107072	Total Organic Carbon Dissolved	gvs	<	1.0	mg/l
107072	Total Organic Carbon Dissolved Duplicat	e gvs	<	1.0	mg/l
i gradin	Mark Vinder Control of the Control o				
: <u>.</u>					



ANALYTICAL REPORT

TO: K & S Testing & Engineering

3623 43rd Street Highland In 46322

ATTN: Mr. Dibakar Sundi

DATE: 06/29/87

RE: Griffith Landfill

MW-1

GCL # PARAMETERS	ANALYST	RESU	LTS
107073 Chemical Oxygen Demand Dissolved	sah	8	mg/l
107073 Chlorides, Dissolved	lam	15	mg/l
107073 Hardness, Dissolved	bjw	1080	mg/l
107073 Iron, Total	bjw	24.1	mg/l
107073 Solids, Total Dissolved	bt	500	mg/l
107073 Total Organic Carbon Dissolved	gvs	3.3	mg/l
107073 Total Organic Carbon Dissolved Duplic	cate gvs	4.0	mg/l
			-
	······································		



ANALYTICAL REPORT

TO: K & S Testing & Engineering

3623 43rd Street Highland In 46322

ATTN: Mr. Dibakar Sundi

DATE: 06/29/87

RE: Griffith Landfill

MW-2

GCL * PARAMETERS ANALYST RESULTS 107074 Chemical Oxygen Demand Dissolved sah < 5 mg/l 107074 Chlorides, Dissolved lam 4 mg/l 107074 Hardness, Dissolved bjw 853 mg/l 107074 Iron, Total bjw 19.1 mg/l 107074 Sclids, Total Dissolved bt 480 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	•			
107074 Chlorides, Dissolved bjw 853 mg/l 107074 Hardness, Dissolved bjw 853 mg/l 107074 Iron, Total bjw 19.1 mg/l 107074 Solids, Total Dissolved bt 480 mg/l 107074 Total Organic Carbon Dissolved gvs 4.9 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	GCL # PARAMETERS	ANALYST	RES	ULTS
107074 Hardness, Dissolved bjw 853 mg/l 107074 Iron, Total bjw 19.1 mg/l 107074 Solids, Total Dissolved bt 480 mg/l 107074 Total Organic Carbon Dissolved gvs 4.9 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	107074 Chemical Oxygen Demand Dissolved	sah	< 5	mg/l
107074 Iron, Total bjw 19.1 mg/l 107074 Solids, Total Dissolved bt 480 mg/l 107074 Total Organic Carbon Dissolved gvs 4.9 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	107074 Chlorides, Dissolved	lam	4	mg/l
107074 Solids, Total Dissolved bt 480 mg/l 107074 Total Organic Carbon Dissolved gvs 4.9 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	107074 Hardness, Dissolved	bjw	853	mg/l
107074 Total Organic Carbon Dissolved gvs 4.9 mg/l 107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	107074 Iron, Total	bjw	19.1	mg/l
107074 Total Organic Carbon Dissolved Duplicate gvs 5.6 mg/l	107074 Solids, Total Dissolved	bt	480	mg/l
	107074 Total Organic Carbon Dissolved	gvs	4.9	mg/l
	107074 Total Organic Carbon Dissolved Duplicat	e gvs	5.6	mg/l
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ANALYTICAL REPORT

TO: K & S Testing & Engineering

3623 43rd Street Highland In 46322

ATTN: Mr. Dibakar Sundi

DATE: 06/29/87

RE: Griffith Landfill

MW-3

GCL # PARAMETERS	ANALYST	RESU	LTS
107075 Chemical Oxygen Demand Dissolved	lam	11	mg/l
107075 Chlorides, Dissolved	lam	28	mg/l
107075 Hardness, Dissolved	bjw	996	mg/l
107075 Iron, Total	bjw	17.3	mg/l
107075 Solids, Total Dissolved	bt	570	mg/l
107075 Total Organic Carbon Dissolved	gvs	6.1	mg/l
107075 Total Organic Carbon Dissolved Duplic	cate gvs	6.9	mg/l
	·		
	· .	<u> </u>	1.50 PM



ANALYTICAL REPORT

TO: K & S Testing & Engineering

3623 43rd Street Highland In 46322

ATTN: Mr. Dibakar Sundi

DATE: 06/29/87

RE: Griffith Landfill

MW-4

GCL #	PARAMETERS	ANALYST	RESULT	S
107076	Chemical Oxygen Demand Dissolved	lam	62	mg/l
107076	Chlorides, Dissolved	lam	90	mg/l
107076	Hardness, Dissolved	bjw	405	mg/l
107076	Iron, Total	bj₩	6.80	mg/l
107076	Solids, Total Dissolved	bt	540	mg/l
107076	Total Organic Carbon Dissolved	gvs	2.4	mg/l
107076	Total Organic Carbon Dissolved Duplicat	e gvs	2.5	mg/l
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SUBURBAN LABORATORIES, Inc.

EXHIBIT 45

4140 LITT DRIVE

HILLSIDE, ILLINOIS 60162 - 1183

EARL I. ROSENBERG President May 6, 1986

H.R. THOMAS, JR. Director

K & S Testing and Engineering Inc. 9715 Kennedy Avenue Highland, Indiana 46322

Attention: Mr. Dibakar Sundi,

Project Engineer

Samples Received: 4/29/86	Cation Exchange (meq/100g)
Soil Samples / Griffith Landfill	
S/L #6-4558 - Sample #1, Depth 0 - 2.0 ft.	5.64
S/L #6-4559 - Sample #2, Depth 2 - 3.5 ft.	5.55

ANALYSIS CERTIFIED BY:

,Director(HRT/ak)